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ABSTRACT

A study was conducted of the physical plant maintenance department (PPMD) of Southwest Texas Junior College (SWTJC), in order to determine if the department was structured as a functional organization, if maintenance control procedures were in place, and if efficient management practices were being used. Consultations with the director of the PPMD and the air conditioning heating technician, as well as an examination of department and personnel records, revealed the following: (1) inadequate control measures for conducting maintenance; (2) an absence of a training program for maintenance personnel; (3) unconfirmed alignment of work positions due to lack of an organization structure chart; and (4) insufficient managerial competencies for personnel in supervisory positions. Subsequently, two organizational charts were created; the first reflected the PPMD's current structure, while the second suggested revisions to the structure designed to improve utilization of human, material, and financial resouces. Drawing on a review of the literature, a general maintenance employee training program was developed which included job breakdown sheets, and a key-point checklist. In addition, SWTJC's president established the Long Range Planning Committee for Physical Plant Maintenance and Energy Management to oversee ongoing organizational changes. Appendixes include the training breakdown sheets and checklist, sample employee training record forms, an instructional system model, and list of problem solving techniques for the workplace. (MAB)

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THE DESIGN OF MANAGEMENT PRACTICES TO IMPROVE THE PHYSICAL PLANT MAINTENANCE OF SOUTHWEST TEXAS JUNIOR COLLEGE

Governance and Management Seminar

by

Wilford Winston Box, M.A., C.M.

Southwest Texas Junior College

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A Practicum Report presented to Nova University in partial fulfillment of the requirements for the degree of Doctor of Education

Nova University

August, 1992

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THE DESIGN OF MANAGEMENT PRACTICES TO IMPROVE THE PHYSICAL PLANT MAINTENANCE OF SOUTHWEST TEXAS JUNIOR COLLEGE

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August, 1992

The Physical Plant Maintenance Department (PPMD) of Southwest Texas Junior College (SWTJC) was examined to determine if it was structured as a functional organization, if maintenance control procedures were in place, and if proficient management practices were being used. Therefore, the purpose of this study was to determine if improvement was needed in management practices being applied within the PPMD.

Research questions used in this study were: (1) Are management procedures currently set up that describe and direct preventive, periodic, and scheduled maintenance? (2) Is a formal organization structure chart of the PPMD established? (3) Do training records exist for each employee and is proficiency level for each task documented? (4) Are problem-solving and decision-making techniques used by the maintenance staff? And, (5) Have maintenance

managers and crew supervisors completed formal college courses and/or seminars in the discipline of management?

Procedures for conducting this study were twofold: (1) Consultations with the Director, PPMD to determine what actions were being taken to accomplish maintenance for SWTJC, and (2) Consultations with the Long Range Planning Committee for Physical Plant Maintenance and Energy Management (LRPC-PPM) for their assessment and approval of newly designed structure charts.

The results of this study revealed: (1) inadequate control measures for conducting maintenance, (2) absence of a training program for maintenance personnel, (3) unconfirmed alignment of work positions due to nonexistence of an organization structure chart, and (4) insufficient managerial competencies for personnel in supervisory positions. It was concluded, therefore, that substantial improvements were needed to bring the PPMD in line with expected standards.

It was recommended that action be taken by the President of SWTJC, and the LRPC-PPM to evaluate this report, submit it to the SWTJC Board of Trustees, and request their approval for adoption and implementation.

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Chapter 1

INTRODUCTION

The purpose of this study was to examine the current management practices used by the Physical Plant Maintenance Department (PPMD) of Southwest Texas Junior College (SWTJC), and determine if there was a need to design management practices for the improvement of the physical plant maintenance. The current management practices were found to be unstructured, not fully controlled, and required added managerial methods to provide more effective plant management.

The President of SWTJC encouraged and supported this investigative study and stated that the study was needed to support the required maintenance management plan that must be completed by 1995. Thus, this proposed study was developed in accordance with the express needs of SWTJC and within the parameters set forth by the President of the college.

This assessment of the proper managerial approach to quality maintenance functions has built a pattern that, when implemented, will enhance the total effectiveness of SWTJC. This was deduced by the fact that maintenance is linked to all operational facets of the institution and will continue to serve the widespread needs of all people on the campus of SWTJC.

Background and Significance

The Physical Plant Maintenance Department (PPMD) of Southwest Texas Junior College (SWTJC) was not properly structured as a functional organization, lacked maintenance control procedures, and was not using proficient management practices. Therefore, the purpose of this study was to determine if improvement to this problem could be realized by designing management practices aimed at improving maintenance functions and service for the physical plant.

The following specific functions were not developed in order to create a more effective managerial approach toward rectifying these problems within the maintenance department:

1. There were no established procedures to direct a preventive, periodic, or scheduled plan of maintenance. Preventive and periodic maintenance was not set to a comprehensively ordered system that laid out what should be done when, on a futuristic basis. Scheduled maintenance was being accomplished primarily by using work order requests, but controls were needed to ensure more effective documentation of completion of each job, by whom, and the amount of time used for each job.

2. An organization structure chart was not set up to depict each position, in the PPMD, and show authority lines to connect those positions into an orderly arrangement for each employee. This was categorized as a major inadequacy

due to the fact that there was no established structure from which to launch an adequate program to conduct the affairs of the PPMD.

3. There was no evidence of a training program for worker-level employees, or for those responsible for training employees at the worker level. A lack of refresher training in the form of seminars, workshops, or college level courses was noted when personnel records of supervisory personnel were reviewed.

4. Structured problem-solving and decision-making techniques were not in place, therefore, there was no standardized approach toward solving problems and deriving decisions.

5. Personnel records revealed there was no documented evidence that maintenance managers and crew supervisors had attended advanced or refresher training in their area of specialization. For example, the air conditioning and heating technician needed up-date training that had not been completed or scheduled for a future date.

6. After a review of the procedures for recording maintenance actions, it was concluded that records were incomplete, lacked historical chronological sequence of events, did not reveal adequate control procedures, and did not reflect the amount of time expended on maintenance actions.

7. A basic limitation to this study was considered to be a lack of managerial expertise by those who are expected to implement and practically apply these newly designed management practices.

These problematic situations were viewed as being significantly detrimental to the operation of the physical plant and that improvements in the structure of the maintenance department were in order. Also, a number of procedural changes were assessed and considered feasible for implementation.

Finally, the overall analyses of the maintenance functions indicate these problems were not recent problems but had been present over a protracted period of time. This conclusion was drawn from discussions with the Director, PPMD, consultation with the Long Range Planning Committee for Physical Plant Maintenance and Energy Management (LRPC-PPM), the absence of a graphic display of organization structure, a lack of documented procedures for maintenance actions, and inadequate methods for decision-making that served to thwart rather than promote a more proficient system of management.

This study had a direct relationship to the seminar on Governance and Management since a faction of the internal physical environment of the college, that was discussed during the seminar, became a major part of this study.

The President of SWTJC deemed this a necessary study in order to enhance the total effectiveness of the college operation, especially since maintenance is linked to all facets of the college system. The President's interest in this study is evidenced by the fact he, as a result of the initiation of this study, formed the LRPC-PPM for the express purpose of assisting in the planning and also the implementation of a more viable maintenance program and energy management system.

Research Questions

The research questions used in this study were as follows:

1. Are management procedures currently set up that describe and direct preventive, periodic, and scheduled maintenance for specified functions such as air conditioning, heating, lighting, and the upkeep of buildings and grounds of the physical plant?

2. Is a formal organization structure chart of the maintenance department established to depict the formal pattern of interactions and coordination between officials and workers?

3. Do training records exist for each employee and if they do exist is proficiency level for each maintenance task documented? Also, is remedial training required for the employee, and if so has remedial training been completed?

4. Are problem-solving and decision-making techniques used by the maintenance staff?

5. Have maintenance managers and crew supervisors completed formal college courses, workshops, and/or seminars in the discipline of management?

Chapter 2

REVIEW OF THE LITERATURE

During the formulation stage of this study the literature was reviewed to determine the best approach to follow toward developing procedures for the study. As stated by DuBrin; Ireland; and Williams (1989:450): "An effective control system cannot be developed unless appropriate performance standards are established." Also, Terry (1981:115) said

> Controlling is in the nature of a checkup to make sure that what is done is what is intended. It must be objective oriented. A means to an end, it is designed to get people to do what must be done to accomplish goals.

Therefore, attention was directed toward the control system and the performance standards being used by the Physical Plant Maintenance Department (PPMD), to determine which management designs and practices were needed to provide the best maintenance for the college. Also, due to Texas state funding reductions that adversely impact higher education and recessionary difficulties within the nation, SWTJC must search for ways to permanently cut costs. This was addressed by Drucker (1991:A3) when he stated

> Cutting staffs to cut costs is putting the cart before the horse. The only way to bring costs down is to restructure the work. This will then result in reducing the number of people needed to do the job, and far more drastically than even the most radical staff cutbacks could possibly do. Indeed, a cost crunch should always be used as an opportunity to re-think and to re-design operations.

> The question of how to organize the restructured organization for maximum performance and minimum cost comes only at the very end. More computers to handle more data faster is rarely the right answer. To be sure, the end product will be in many cases expressed by a computer program. But the task is to define what information is needed rather than how to manipulate it.

The foregoing information provided by Drucker is further amplified by his assertion (1991:A3), "It is always amazing how many things we do will never be missed. And nothing is less productive than to make more efficient what should not be done at all."

Tellefsen (1990:446) in addressing plant operation and management states

> The primary role of the physical plant department is to assist in planning, creating, maintaining and operating a physical environment that is conducive to learning, teaching and research. This environment should be as attractive, safe, and free of operating difficulties as the efficient and effective use of the available resources will permit . . all these facilities in a living, learning, and research environment involve the utilization of sophisticated, complex operating and support systems that must be maintained to be kept operational twenty-four hours a day.

In view of the above, it was decided to primarily consult with the Director of the PPMD, and the air conditioning/heating technician to collect information and facts relevant to the progress of this study. The President of SWTJC was also consulted to determine his desires and guidance in deciding the best course of action to pursue and which management practices, among those suggested, should be employed to improve the effectiveness of current practices in the PPMD.

Furthermore, the President of SWTJC, when consulted about the initiation of this type study, decided to provide an added dimension by forming the LRPC-PPM in order to gain a group consensus on the salient issues that were surfaced during the process of the study. This line of thinking is in accordance with Fred Luthans (1985:369) who adds emphasis to the establishment of a committee when he stated

> Committee action has many advantages over individual action . . to speak optimistically, committee members bring with them a wide range of experience, knowledge, ability, and personality characteristics. This agglomeration lends itself to the tremendous amount of diverse knowledge that is required to solve modern organizational problems.

As a consequence of this type information by Luthans, the LRPC-PPM was used frequently during the course of this study. The members of the LRPC-PPM provided valuable insight and input that was instrumental in bringing the study to a fruitful conclusion, in that, improved management practices were established for use by the PPMD.

This study had a direct relationship to the seminar on Governance and Management, especially during one segment of the seminar when a quote was used from Thompson and Strickland's book entitled, "Strategy Formulation and Implementation", (1980:2)

> Just why managerial performance of the strategy and policy functions contributes mightily to an organization's success or failure is rooted in the familiar expression -- if you don't know where you are going, any road will take you there. The point, very

> simply is that the management of the total enterprise cannot be left to circumstance, spur-of-the-moment decision, chance happenings, and whatever comes over the threshold. Whatever will be will be, is not a recipe for successfully conceiving and directing the totality of an organization's activities.

These literature sources indicated this type of study was in line with the problems discovered within the physical plant maintenance department of the college, and served as a guideline toward formulation of the study. This search of the literature also led to questions concerning the type of decision-making process used by those within PPMD. As stated by Steiner and Miner (1977:209)

> The decision-making process for the most significant decisions made by top executives will vary from organization to organization. Each process is unique because involved in the decision making will be managerial value systems and judgements; internal political forces; interpersonal relationships; and individual managerial skills, capabilities, motivations, and values.

After considering this literature source, a format for decision-making was recommended for use by the Director of PPM and was considered sufficiently flexible to be of value to the maintenance department.

Another consideration that arose during the research was the importance of working with a committee in collecting the information instead of working single-handedly. Chruden and Sherman (1984:57) asserted

> Committee membership provides employees with a means of contributing their knowledge and experience to the organization . . by working as committee members employees have the opportunity to express their viewpoints and to understand those of management

> and of fellow employees. In addition, they are made more familiar with the operating problems of the organization and gain experience in the problems and processes of making decisions.

As a result of the above information provided by Chruden and Sherman, a three-member committee was formed that consisted of the Director of PPMD, the Air Conditioning/Heating Technician, and the individual conducting this study. Those three officials remained in close contact and held weekly discussions and fact finding for the duration of this research endeavor.

Another realization that required attention was that strategic issues require top-management decision-making. As stated by Pearce and Robinson (1991:3)

> Since strategic decisions overarch several areas of a firm's operations, they require top-management involvement. Usually only top-management has the perspective needed to understand the broad implications of such decisions and the power to authorize the necessary resource allocations.

Since officials in the PPMD would be needed to assist in this research, it was decided, before starting the research to gain authorization from the President of SWTJC to use those managers from the PPMD as a support group. Also, to solicit support from other officials in the strategic apex in order to gather the information required for this project.

When considering the development of an organization structure chart to display how the physical plant maintenance department was presently structured, and how

it should be altered in structure, valuable information was gained from Bittel and Ramsey (1985:653) when they stated

> Charts, like manuals, can (1) promote understanding of communication problems, (2) orient newer people to structural relationships and complexities, and (3) provide a graphic picture of the full sweep of organizational activities and services, and the units and personnel central to them.

It was decided, therefore, since there was no structure chart available, to develop two organization structure charts that described both the current, and proposed, structure of the PPMD.

Another problem discovered during the research was the absence of a training program for maintenance personnel. Schuler and Youngblood (1986:395) advocated

> The three major phases of any training and development program are (1) assessment, which determines the training and development needs of the organization; (2) implementation (actual training and development), in which certain programs and learning methods are used to impart new attitudes, skills, and abilities; and (3) evaluation.

The use of a Model for an Instructional System, based upon the theory created by Schuler and Youngblood, was deemed appropriate and is included in Appendix D of this paper to provide guidelines toward creation of a training program. Also, Bittel (1985:250) states

> Breaking a job down for training purposes involves two elements: First, you must observe the job as it is done and break it into its logical steps . . . . Second, for each step in a job breakdown, you must now consider the second element--called the key point. A key point is anything at a particular step that might make or break a job or injure a worker.

A job breakdown sheet for training and a key-point checklist are included in Appendix A and Appendix B, respectively, that prescribe methods for conducting a basically ordered training program.

The culmination of the foregoing literature sources provided the foundation, direction, and authoritative basis to conduct this study. Also, a plethora of information was available that permitted a comprehensive re-design of the management practices that were needed to overhaul this system and establish more effective and proficient methods for conducting physical plant maintenance at Southwest Texas Junior College.

Chapter 3

METHODOLOGY AND PROCEDURES

The Director, Physical Plant Maintenance (DPPM), and the Air Conditioning/Heating Technician, were the primary officials that were consulted to determine what current physical plant maintenance practices were being used to provide a functional and attractive campus environment for the college. The information obtained from those two officials comprised the basic source of information used in this study.

Records were examined to determine what management procedures were currently being used to describe and direct a preventive, periodic, and scheduled maintenance format. Information was so sparse, records wise, that the DPPM and the Air Conditioning/Heating Technician were relied upon to provide verbal information into procedures being used to direct the maintenance activities such as air conditioning, heating, lighting, and the upkeep of buildings and grounds of the physical plant.

The organization structure chart was requested from the DPPM, but it was discovered this type chart did not exist. Therefore, it was decided to prepare both a current and a proposed organization structure chart, since this was considered vital toward launching this study. The formal pattern of interactions and coordination between officials

and workers in the physical plant was ascertained, and therefore, provided the necessary framework to proceed with the study.

There were no training records in the maintenance department established for employees, thus, questions pertaining to an employee training program were directed to the DPPM. The DPPM was asked if there were procedures established to record the proficiency level demonstrated by each employee on each task performed; if procedures were set up to record the need for, and completion of, remedial training. It was discovered that no training program was established.

The DPPM was asked if problem-solving and decision-making techniques were being used, based upon a structured format to direct that type action. There were no structured procedures for this managerial activity.

The personnel records on five managerial/supervisory level officials were reviewed to determine what type of maintenance training and/or management training had been recorded. Permission to conduct this personnel records review was obtained from the President of SWTJC and from the five officials whose records were reviewed.

And, finally, the President of SWTJC was contacted and permission was requested, and granted, to begin this study which included all of the procedural activities outlined above.

Definition of Terms

1. Periodic Maintenance: Maintenance that is set up to be performed at specified intervals in the projected operation cycle of a mechanical part, fixture, system, or activity.

2. Preventive Maintenance: Maintenance that is performed in an attempt to preclude further damage or problem to a mechanical part, function, system or fixture.

3. Scheduled Maintenance: Maintenance requested by a college official, mandated by the strategic plans designed by upper-level managers of SWTJC, or maintenance that is directed within the maintenance department to ensure the proper functioning of those systems that support SWTJC.

Assumptions

It is assumed that officials in the top levels of management at SWTJC will ensure the proposed management practices that are outlined in this study will be set into motion. Also, it would be feasible to adopt the newly designed Organization Structure Chart (Figure 5, page 28) since virtually everything in this study is dependent upon those changes shown in the proposed structure of the PPMD.

It is anticipated that if those described management changes are implemented the college will benefit by more effective utilization of human, material, and financial

resources. Furthermore, an improved and orderly maintenance process will lead to a better maintained campus that will serve the needs of administrators, staff, faculty and students alike. Improved grounds maintenance will add an aesthetic appeal for campus personnel as well as for visitors and guests who view the buildings and grounds of our professional home.

Limitations

Since this study has revealed that corrective management procedures are needed, there may be limitations in practically setting those procedures in place. This is due to the lack of managerial competencies possessed by those in management positions who are expected to implement those newly developed practices. Furthermore, the current functional structure of the physical plant maintenance department, (refer to Figure 4, page 27), does not have proper staffing to carry out the revised requirements set forth in this study, unless the proposed organizational structure chart, (refer to Figure 5, page 28), is adopted and implemented.

A further limitation is the lack of computer support equipment dedicated solely for use within the maintenance department to store the information data base that is required for monitoring and controlling this newly devised management system.

Chapter 4

RESULTS

The literature that applied to management practices in the workplace was reviewed and that review led to the development of the foundation for this study. This literature provided guidance for establishing a management control system, a revised organization structure chart, and described the primary mission of the Physical Plant Maintenance Department (PPMD). Also, this search of the literature provided methods to be used by the PPMD when considering problem solving situations by using an itemized format to develop decision-making and solve problems, and the importance of working with committees instead of attempting to collect information single-handedly. This resulted in establishing a three-person committee to collect information needed for compiling this study, and a seven member Long Range Planning Committee for Physical Plant Maintenance and Energy Management (LRPC-PPM), to assess the findings that were produced by this research.

The literature review also produced information that was instrumental in formulation of a training program for the PPMD employees. A general training program was developed that included a job breakdown sheet for training and a key-point checklist that prescribed ways to conduct a training program, and account for remedial training.

It was determined that management procedures were not in place to adequately describe and direct a preventive, periodic, or scheduled maintenance system relating to specified functions such as air conditioning, heating, lighting, and the general upkeep of buildings and grounds. Therefore, to correct those deficiencies a LRPC-PPM was created by the President of SWTJC, primarily as a result of the initiation of this study.

The LRPC-PPM was formed to assess factors raised by this research effort and to provide continuing support for the PPMD. The committee was composed of seven members: (1) the President of SWTJC, (2) the Director of PPMD, (3) the Air Conditioning/Heating Technician, (4) the Director of Administrative Services, (5) Division Chairman of Humanities and Fine Arts [Chairman of the LRPC-PPM], (6) Data Processing/Management Faculty Member, and (7) the Instructor-Coordinator, Business Management.

The LRPC-PPM met twice each month, October 1991 through April 1992, to discuss procedures that were developed to improve the physical plant maintenance. There was complete agreement, by committee members, that a revised management system was needed when the current organization structure chart was reviewed. However, there was disagreement on some elements of the proposed structure chart. The disagreement was directed toward the proposed position of a Training/Safety Manager. The committee

recommended this proposed position be removed from the PPMD proposed organization structure chart, with the stipulation that the position would be added at a later date to the SWTJC general administration structure chart as a Personnel Director position. Also, that the Assistant Custodian position be realigned to a basic custodian worker position (refer to Figure 5, page 28).

The final consensus of the LRPC-PPM, based upon the results of this study, was to proceed as follows:

That corrective actions were needed for directing preventive, periodic, and scheduled maintenance for functions such as air conditioning, heating, lighting and the general upkeep of buildings and grounds of the physical plant. Therefore, the Events Control Chart (Figure 1, page 21) will be used in concert with the Process of Control (Figure 2, page 23), and the Actual Project Completion (Figure 3, page 24), that are shown in the format of line continuums. This chart and the line continuums will be used to create control and establish documentation for maintenance activities.

This Events Control Chart was designed with the following specific items: (1) Organization Title. To be used to identify the organization, department, or section; (2) Project Title. To be used in identifying the specific project in process; (3) Project Frequency. To be used to indicate if project is annual, quarterly, monthly, or other

Organization: Air Conditioning/Refrigeration Department

Name of Repairman: Slade Rigsby

Project Title: Preventive Maintenance for Air Conditioning/Heating Units.

Proposed Start Date: October 2, 1991. Proposed Completion Date: Oct 11, 91

Actual Start Date: October 3, 1991. Actual Completion Date: Oct 12, 91

Project Frequency: Quarterly.

Event	Oct. 3 *	Oct. 4 *	Oct. 5 *	Oct. 6 *	Oct. 7 *	Oct. 8 *	Oct. 9 *	Oct. 10 *	Oct. 11 *	Oct. 13 *
Change Filters (Disposable); Clean Filters (Reuseable); A/C Units: 2, 4, 6, & 9	----------▶ (Proposed Completion Date)			▶ (Actual Completion Date)						
				----------▶						
						▶				
Oil A/C Unit Bearings: Units 1, 3, 5, & 8							----------▶			
								▶		
Check Coolant Levels; adjust if needed									----------▶	
										▶

*Time Intervals: May be established as year, month, week, day, hour or buffer zones.

Figure 1

Events Control Record Chart

Note: Chart is designed for use with The Process of Control, page 23.

time phase. (4) Proposed Start Date. This will show the projected date to begin an action. (5) Proposed Completion Date. This date will be derived by estimating amount of time required to complete an action. (6) Actual Start Date. This element will contain the specific day, month, and year the action was started. (7) Actual Completion Date. The specific day, month, and year that project was completed. (8) Event. Each event used toward completion of the total project will be shown in this vertical column. (9) Time Intervals. This series of horizontally segmented columns will be used to display the length of time required to perform each event that is listed in the Event column. These time increments, identified with an asterisk (*), may be used by tailoring them to a specific time to show the amount of time, such as minutes, hours, days, week, month, or other time phase designated to fit the project being tracked for control purposes. Immediately below these designated time intervals are line continuums (or time lines). The broken lines or dashes are used to denote the proposed time for completion of an event; the unbroken or solid lines are used to denote the actual completion of an event.

The Events Control Chart that depicts the specific elements required in a project, may be developed from, and tracked with, a graphic display of The Process of Control (Figure 2, page 23), and Proposed Control Standard

(Figure 2 -- below). The line continuum in Part A is used for projecting the proposed standard and goal, whereas the line continuum in Part B is used to show actual project completion and actual goal attainment for a project.

The Process of Control

Part A: Projected Project Planning Standard. The line continuum shown below is used to project time increments from beginning to the conclusion of a project; a futuristic ideal that establishes time intervals that are critical junctures for predetermined events to occur or to be completed. The line continuum is designed to reflect the projected completion time allotted to each specified function or event. Certain increments of time, in the total line continuum, may be designated as buffer zones to compensate for unexpected occurrences. This futuristic proposed standard is used in conjunction with the Events Control Chart to track a project from beginning to completion of a projected goal:

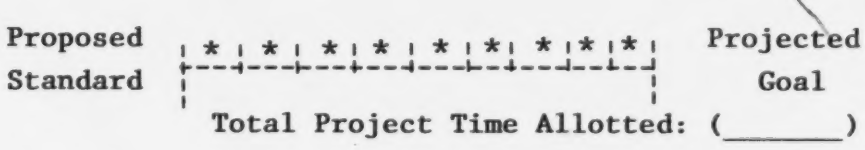

Figure 2

Proposed Control Standard

NOTE: *Each asterisk represents an amount of time projected in the plan (year, month, week, day, hour, buffer zone, or other time interval).

Part B: Actual Project Completion. The line continuum shown below is used to show the actual progress being made as the plan (shown in Figure 2) is put into motion and compared against that Proposed Control Standard. The actual progress of each specified function or event is compared against the Proposed Control Standard to ascertain if progress is in accordance with the standard. Adjustments are made, to the degree possible, using buffer zones and/or altering activities that are in process. Buffer zones are built-in time increments to compensate for the unknown factors that may arise to disrupt a project in process. For example, if the Projected Goal, shown in Figure 2, page 23, has been established for completion in sixty days, five additional days may be added as buffers in an attempt to cover those functions that may not occur at the time interval projected. Therefore, the success of the Actual Project Completion will depend upon the amount of flexibility initially built into the Proposed Control Standard.

The line continuum below is used to represent the Actual Project Time used to reach the Actual Goal:

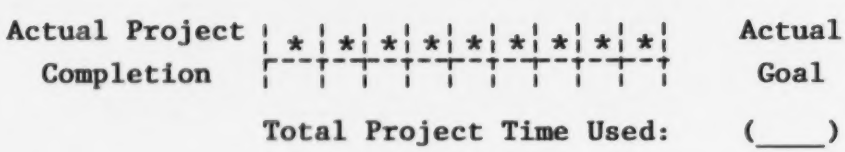

Figure 3

Actual Project Completion

NOTE: *Each asterisk represents the actual time used to complete a project and arrive at the actual goal.

The broken lines, or dashes, used in the Part A line continuum correspond to the broken lines, or dashed lines, shown on the Events Control Chart (Figure 1, page 21), and the solid lines used in the Part B line continuum correspond to the solid lines shown on the Events Control Chart.

The Events Control Record Chart may be modified to fit a special or unique requirement of the project being controlled. It will also serve as a historical record that may be referred to as other projects and future events are planned. This chart, therefore, may be used and modified as necessary to plan, organize, direct, and control all periodic, preventive, and scheduled maintenance requirements of the PPMD. This device is a method of control to show which maintenance tasks are being done, who is doing them, the frequency of the task, and length of time expended on those tasks.

The next major decision in this study was directed to the charting of both a current and proposed organization structure chart, since there was no organization structure chart established for the PPMD. This was considered to be the most crucial element of this study since the structure chart delineates the formal pattern of interaction and coordination between the positions within the PPMD.

Therefore, an organization structure chart was designed to show the current organization structure of the PPMD (Figure 4, page 27). After analyzing each position shown in the current structure, an organization structure chart was designed to depict the proposed configuration for the PPMD (Figure 5, page 28). It was decided that the current chart of the PPMD was deficient in the following: (1) lack of an assistant administrative position to support the Director of PPMD, (2) lack of secretarial support, (3) excessive salary ranges were set for the Carpenter position and the Painter position. Using both of these positions was considered an overstaffing problem, (4) the Assistant Custodian position was considered not essential, and (5) the Grounds Maintenance Section staffed with five employees was recommended for replacement with an off-campus contract.

The following realignment of the PPMD organization structure (Figure 5, page 28) was discussed and approved by the LRPC-PPM, contingent upon final approval by the SWTJC Board of Trustees. Position realignment and salary adjustments are shown in (Table 1, page 29) and are explained as follows:

1. Add a part-time, twenty-hour per week, Secretary position to provide typing, filing, records maintenance, receptionist duties, data entry, and other tasks as directed. Establish annual salary at $4,420.

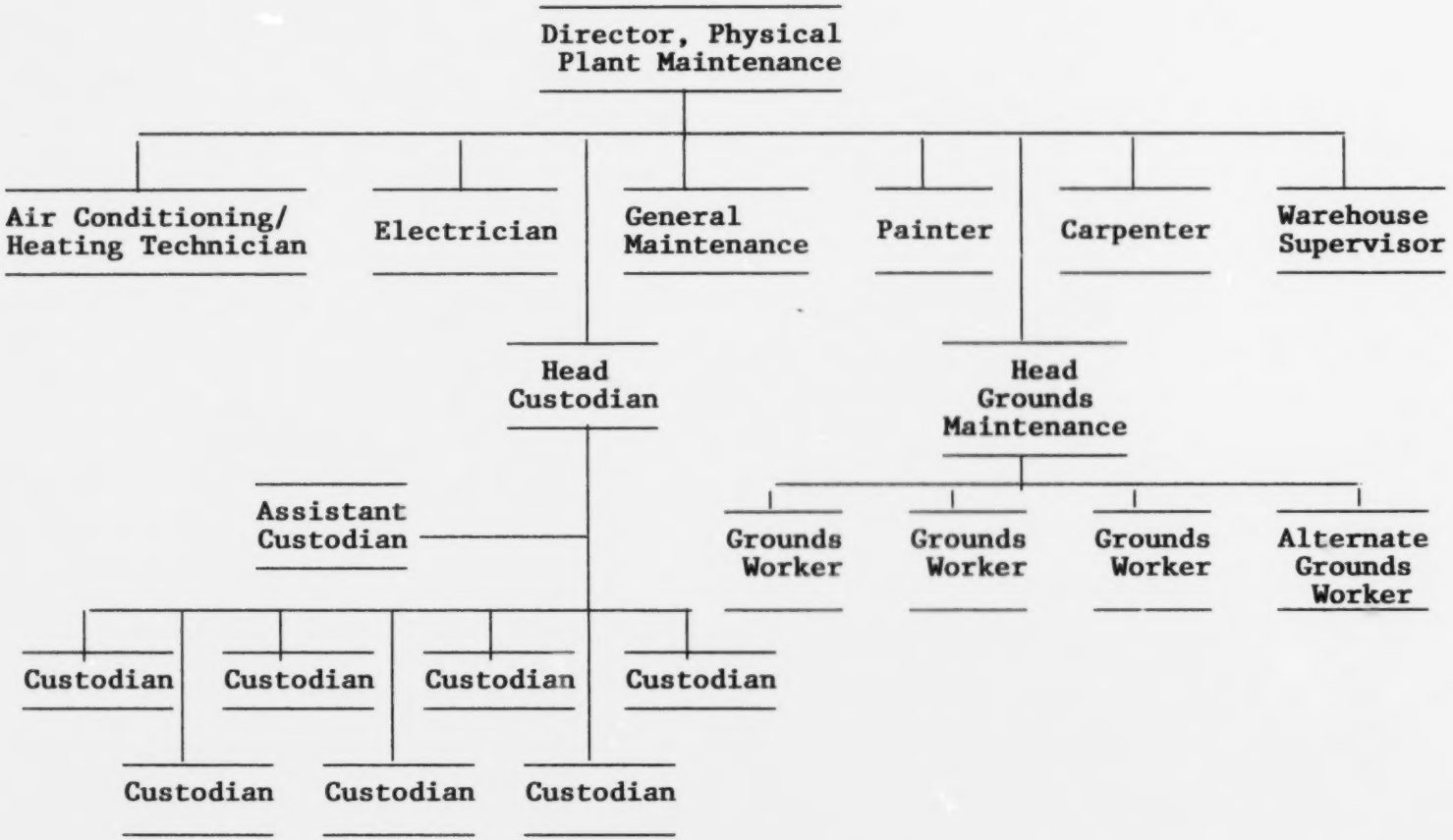

Figure 4

Current Organization Structure Chart

Physical Plant Maintenance

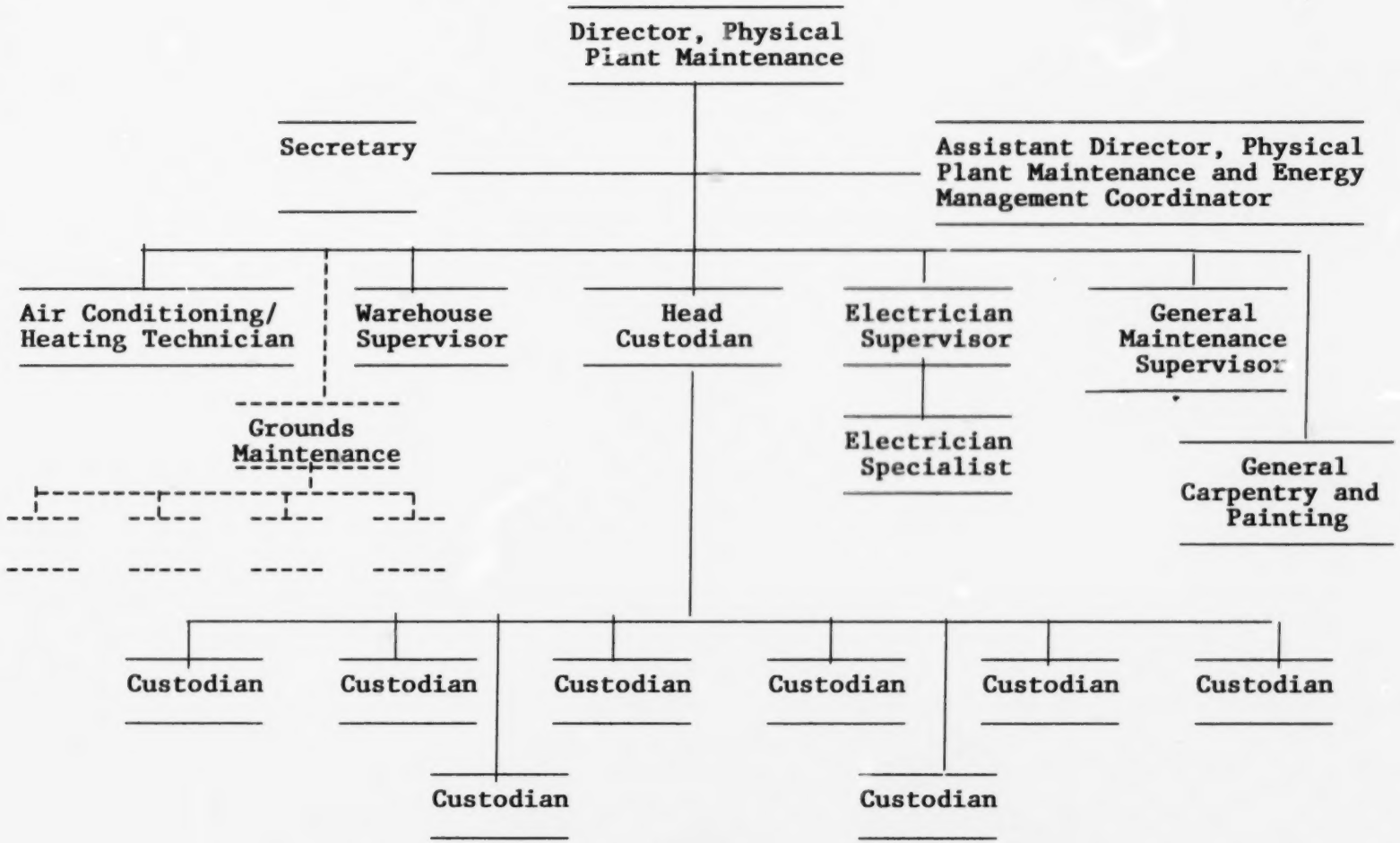

Figure 5

Proposed Organization Structure Chart

Physical Plant Maintenance

Table 1

Added Positions and Salary Adjustments for the Physical Plant Maintenance Department Proposed Organization Structure Chart

	Position	Current Salary	Proposed Salary	Cost Savings
1.	Secretary. Part-time 20 hours per week @ $4.25 per hour X 1040 hours. Annual Salary:	--	$4,420	--
2.	Assistant Director of Physical Plant Maintenance & Energy Management Coordinator. Annual Salary:	--	32,000	--
*3.	Carpenter. Full-time $15.15 per hour X 2080 hours. Annual Salary:	$31,512	--	--
*4.	Painter. Full-time $14.42 per hour X 2080 hours. Annual Salary:	29,993	--	--
5.	*Carpenter/Painter. Combine into one position and set Annual Salary:	--	24,960	--
6.	Assistant Custodian. $7.12 per hour X 2080 hours. Annual Salary:	14,810	--	--
	Convert this position to: Custodian. $6.63 per hour X 2080 hours. Annual Salary:		13,790	--
	Totals	$76,315	$75,170	$1,145

2. Add an Assistant Director of Physical Plant Maintenance/Energy Management Coordinator. Establish annual salary at $32,000. This provided the assistance needed to support the Director, PPMD, add two-deep management capability, and provided for the close scrutiny and planning for improved energy management.

3. The Carpenter position with an annual salary of $31,512 and the Painter position with an annual salary of $29,993 for a combined salary of $61,505 is projected for conversion to one position, Carpenter/Painter, with a revised salary of $24,960.

4. The Assistant Custodian position was targeted for deletion and redesignated as a Custodian worker position. Salary range is projected to be adjusted from the current $14,810 to $13,790.

Table 1, page 29, shows the current and proposed salary ranges for added positions/salary adjustments, and a cost savings of $1,145. It was considered a feasible approach to redesign this structure and provide the necessary strata for control and efficiency in carrying out the tasks of the PPMD. This approach not only provided the necessary structure but also provided for a cost savings.

The final decision on the Proposed Organization Structure Chart (Figure 5, page 28) by the LRPC-PPM was to project the deletion of the Grounds Maintenance Section

that is comprised of a Grounds Maintenance Supervisor and four worker-level positions. This function will be replaced with an off-campus service contract. The off-campus contractor will be required to provide coverage, if that is a desired option, for worker compensation and liability; bodily injury; full coverage for all vehicles and equipment used in the performance of all grounds maintenance. This will result in a substantial monetary savings for SWTJC in salary, and benefits, when this function is converted from a section within the PPMD to an outside contract source.

The rationale for opting for an outside contractor was based on the high operating costs to continue this service as an integral part of the PPMD. For example, Table 2, page 32, shows a current cost of $104,457 per year to operate this Grounds Maintenance Section of the PPMD. Salary amounts to $70,000; benefits, $5,457; equipment, $10,000; and $19,000 is dedicated to supplies, materials, rentals, and small tool purchases. The proposed cost to secure an off-campus contract would not exceed $40,000 and liquidation of existing grounds maintenance equipment will produce, a one-time, $10,000 revenue. Therefore, total annual cost savings and the one-time liquidation of equipment revenue, would amount to $74,457 the first year, and approximately $64,457 annually thereafter.

Table 2

Annual Costs for Current Operation of Grounds Maintenance Compared to an Off-Campus Contract

Category	Current Cost	Proposed Cost	Cost Savings/ Revenue
1. Grounds Maintenance Section, Combined Salaries	$70,000	--	--
Benefits Package	5,457	--	--
2. Equipment	10,000	--	--
3. Supplies, Materials, Rentals, & Small Tool Purchases	19,000	--	--
4. Contract with an Off-Campus Grounds Maintenance Service Approximate cost		$40,000	
5. Liquidate Existing Grounds Maintenance Equipment			$10,000
Totals	$104,457	(-) $40,000	= 64,457
Total Cost Savings/Revenue			$74,457

The next decision reached by the LRPC-PPM concerned the development of a training program for each employee in the PPMD. This training program consisted of three major segments that are discussed as follows:

1. Job Breakdown Sheet for Training (Appendix A). This shows an example of how to break a job down into logical instructional steps with key points to reinforce trainee ability to learn and perform the job.

2. The above training method is reinforced by a Key-Point Checklist (Appendix B). This is a list of sixteen key points that should, or could, happen at each step of a job that directs the job correctly or incorrectly.

3. The third document is a three-part Employee Training Record (Appendix C). Part A, contains elements that identify the division, department, name and social security number of trainee; task proficiency which includes the task, date started/completed, name of trainer and remarks. This will be used to document complete background and extent of training for each employee. Part B, is a Record of Specialized Training that is used to record college courses, seminars, or conferences attended. Part C, Record of Trainee Counseling, was developed to provide a chronological record of counseling sessions and to establish documentation of trainee work history.

4. The final training document is a Model for an Instructional System (Appendix D). This model was included to provide an example of how the training program for PPMD employees could be established. This model includes a three phase approach for providing training instruction: (1) Assessment Phase, where instructional needs are determined to derive objectives for the training program and decide a point of departure in starting employee training; (2) Training and Development phase is used to select training media (materials to be used) and develop learning foci that will be presented to trainee; training will be given; and conditions will be established to maintain required level of proficiency; (3) Evaluation Phase will begin by the trainer developing criteria for the objectives derived; pretest trainees, monitor training; evaluate effectiveness of the training; and evaluate transfer of information taught. Then the cycle repeats for the next block or segment of training.

To develop competencies for PPMD problem-solving and decision-making, Problem Solving in the Workplace, (Appendix E), has been included in this paper to assist the PPMD staff in this managerial competency. This procedural method includes: (1) Identify the Problem; (2) Analyze Factors Surrounding the Problem; (3) Develop Alternatives; (4) Prioritize Alternatives chosen; (5) Choose the Alternative that appears most likely to solve

the problem; (6) Implement the Alternative chosen; and (7) Perform Follow-Up action, periodically, to monitor the stability of the solved problem.

The final result of the research that was discussed by the LRPC-PPM was the lack of training completed by maintenance managers and crew supervisors. During an inspection of training records, maintained in the office of the President of SWTJC, it was discovered there was an absence of completion of college courses and/or seminars in the discipline of management by supervisory level personnel. It is essential for maintenance managers and crew supervisors to develop managerial competencies and attend refresher courses in order to apply the most proficient methods of management in all areas of the PPMD.

Chapter 5

DISCUSSION, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Discussion of Results

It was determined to develop an interrelated system of management procedures that would resolve inadequacies, produced by this study, within the general functioning of the Physical Plant Maintenance Department (PPMD). This decision was reached by relating the procedural actions being used by the PPMD to the information and procedural methods revealed in the literature review that is contained in Chapter 2 of this study.

There was a variety of ways to improve management practices in the PPMD to create a more standardized, methodological, and proficient approach toward providing better service for the campus of SWTJC. The LRPC-PPM, therefore, has agreed that those procedures chosen and developed by this study are generally adequate to realign the managerial techniques and bring the PPMD to higher standards of performance, training, safety, and the achievement of objectives and goals.

This study provides an Events Control Record Chart that was designed to track, control, and record actions pertinent to periodic, preventive and scheduled maintenance and when used in concert with The Process of Control line

continuums, these maintenance actions would be measurably improved. The creation of an organization structure chart, both current and proposed, provided a formal graphic depiction of the positions that comprised the current organization structure and the proposed changes that were designed to build a more functional organization structure. The proposed structure of the PPMD reflected a more functional realignment of human resources.

The Job Breakdown Sheet for Training, a Key-Point Checklist, and a three-part Employee Training Record was deemed essential to provide assistance to those who are responsible for implementing and directing a training program for employees in the PPMD (Appendix A, B, and C). These three training devices were supported by a final document that displayed a Model for an Instructional System (Appendix D). When these four documents are used for the development, implementation, and control of an employee training program, the overall job knowledge of those employees will be improved, thereby creating the capacity for a more efficient PPMD.

The final document, Problem Solving in the Workplace (Appendix E), contains a series of methodological steps to assist the PPMD in problem-solving and decision-making routines. This was determined to be a sufficient aid to enable managers and crew supervisors in deriving higher quality decisions, personally, and also to permit those

managers and crew supervisors to acquire the knowledge needed to teach problem-solving and decision-making applications to other personnel in the PPMD.

Conclusions

The overall results of this study, based upon the five major questions that were established, interviews that were conducted with maintenance personnel, and extensive discussions with members of the LRPC-PPM, revealed there were significant inadequacies in the PPMD of SWTJC. Those inadequacies ranged over a broad spectrum of functions that required personnel in the PPMD to improve upon with a display of proficiency and effectiveness.

This study, therefore, produced results that centered the attention of the leaders of SWTJC upon the problem areas described herein. Thus, attention and progressive action has been focused upon those problem areas and corrective measures outlined in this study will be placed into motion at the earliest practical time.

Progress toward resolving these problems has already been realized since the LRPC-PPM and the President of SWTJC have jointly approached these problems, revealed in this study, with open-minded candor and objectivity. These officials have also pledged their continuing efforts toward refining managerial practices used by the PPMD, and to search for ways to energize programs that will lead to a more effectively operated physical plant.

Implications

As improvements begin to occur, when this study is put into practice, there will be an increase in the morale of members of the campus, and moreover, the maintenance staff will have the opportunity to establish a system of managerial proficiency that will lead to easier and more enjoyable work. Control measures, when implemented, will provide assurance for goal achievement and serve to unify workers, crew supervisors, and managers into a cohesive work group.

As a result of these forthcoming changes, everyone will realize positive changes for the campus. And, those proposed position realignments, on the organization structure chart, will not create uncertainty or concern for personnel currently in those positions. No employee in the PPMD will lose their job due to this reorganization, since employee attrition will be the chosen method to bring about the changes decided upon in this study.

The reorganization of this department is in the best interest of the entire institution since all activities of the college depend upon the effectiveness of the PPMD. The major environmental conditions such as air conditioning, heating, building cleanliness and good maintenance of equipment, aesthetics of the campus grounds, and a well trained and motivated PPMD staff, all combine to create

a desirable campus atmosphere. This, then, leads to a suitable environment for conducting the business and educational programs of Southwest Texas Junior College.

Recommendations for the Improvement of Practice

It is recommended that the Long Range Planning Committee for Physical Plant Maintenance and Energy Management (LRPC-PPM) be continued indefinitely as a decision-making body. This committee gave valuable advice, counsel, analysis, and support for the initiation and finalization of this study. The LRPC-PPM has a membership of dedicated professionals that have the best interest of SWTJC as a high priority and will continue to work for the improvement of maintenance and energy conservation. Substantial monetary savings in energy management has been realized, during this study, as a result of innovations developed by the LRPC-PPM.

However, there are more innovative programs that should be assessed and implemented, such as the computer controlled Johnson Heating/Air Conditioning energy system. This system can be installed on a small scale, using one or more buildings initially, then expanded as funds become available, on a building by building modular basis until the entire campus is operating under a state-of-the-art system of energy efficiency.

The President of SWTJC has been the key figure in this study, since he authorized the research, appointed the LRPC-PPM to support the research, and allowed officials from the PPMD to meet with the researcher and provide the necessary information that made this effort a success. It is strongly recommended, then, that the LRPC-PPM continue to provide support for the President of SWTJC and his programs. Furthermore, the LRPC-PPM should also continue to offer advice and suggestions for change to improve the maintenance of the physical plant and diligently work toward a better energy management system.

A final recommendation is directed toward each and every individual who has given input for this study, that they continue to seek out ways to improve managerial methods and applications for the continued progress of SWTJC. This study will require at least three years to fully implement, therefore, improved managerial techniques by all of our personnel is most desirable. Thus, the continuance of active efforts by the LRPC-PPM, the President of SWTJC, the Director of Physical Plant Maintenance and his staff to elevate the proficiency level of physical plant maintenance is a critical factor. And, the ultimate approval of this study by the SWTJC Board of Trustees is most essential if this plan is to be fully implemented.

This type of study may be the pilot program that will encourage the initiation of other studies, and innovative measures, to keep our professional institution on an unwavering course that will serve administrators, faculty, staff, and especially the most important resource of Southwest Texas Junior College -- our students.

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APPENDIX A

JOB BREAKDOWN SHEET FOR TRAINING

(SAMPLE)

JOB BREAKDOWN SHEET FOR TRAINING

Part: Shaft	Operation: In-feed grind on centerless grinder
IMPORTANT STEPS IN THE OPERATION Step: A logical segment of the operation when something happens to advance the work	KEY POINTS Key Point: Anything in a step that might: Make or break the job Injure the worker Make the work easier to do, i.e., knack, trick, special timing, bit of special information
1. Place piece on plate against regulating wheel.	Knack -- don't catch on wheel
2. Lower lever-feed.	Hold at end of stroke (count 1-2-3-4) Slow feed--where might taper Watch--no oval grinding
3. Raise lever-release.	
4. Guage pieces periodically.	More often as approach tolerance
5. Readjust regulating wheel as required.	Watch--no backlash
6. Repeat above until finished.	
7. Check.	

Source: "What Every Supervisor Should Know.", 5th Edition, by Lester R. Bittel. McGraw-Hill Book Company, 1985, page 250.

APPENDIX B

KEY-POINT CHECKLIST

(SAMPLE)

KEY-POINT CHECKLIST

Key points are those things that should happen, or could happen, at each step of a job which make it either go right or go wrong. Key points include any of the following:

---

1. Feel. Is there a special smoothness or roughness? Absence of vibration?
2. Alignment. Should the part be up or down? Which face forward? Label in which position?
3. Fit. Should it be loose or tight? How loose? How tight? Can you show the trainee? When can you tell that a part is jammed?
4. Safety. What can happen to injure a worker? How are the safety guards operated? What special glasses, gloves, switches, shoes are needed?
5. Speed. How fast must the operation proceed? Is speed critical? How can you tell if it's going too fast or too slow?
6. Timing. What must be synchronized with something else? How long must an operation remain idle--as with waiting for an adhesive to set?
7. Smell. Is there a right or wrong smell about anything--the material, the cooking or curing during the process, the overheating of a machine?

8. Temperature. Is temperature critical? How can you tell whether it is too hot or too cold? What can you do to change the temperature, if necessary?

9. Sequence. Is the specified order critical? Must one operation be performed before another, or doesn't it make any difference? How can the worker tell if he or she has gotten something out of order?

10. Appearance. Should surfaces be glossy or dull? Should the part be straight or bent? How can you correct an unsatisfactory condition?

11. Heft. Is weight important? Can you demonstrate how heavy or light a part or package should be?

12. Noise. Are certain noises expected (purring of a motor)? Unacceptable (grinding of gears)?

13. Materials. What is critical about their condition? How can the worker recognize that? When should the material be rejected? What should be done with rejected material?

14. Tools. What is critical about their condition? Sharpness? Absence of nicks or burrs? Positioning? Handling?

15. Machinery. What is critical about its operation? How is it shut down in emergencies? What will damage it? How can this be avoided?

16. Trouble. What should be done in the case of injury to persons or damage to materials, parts, products, tools, or machinery? How can damage be recognized?

Source: "What Every Supervisor Should Know", 5th Edition, by Lester R. Bittel. McGraw-Hill Book Company, 1985, page 251.

APPENDIX C

EMPLOYEE TRAINING RECORD

PART A, B, AND C

(SAMPLE)

EMPLOYEE TRAINING RECORD

(PART A)

DIVISION: _____

DEPARTMENT: _____

TRAINEE INFORMATION

NAME: _____

[Last Name, First Name, Middle Name]

SOCIAL SECURITY NUMBER: _____

TASK PROFICIENCY

	TASK	DATE STARTED/COMPLETED	NAME OF TRAINER	REMARKS
1.	Air Conditioning Wiring Schematics	Jul 1/Aug 6, 92	G. Saiz	Good progress; follow-up test in 6 weeks.
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

RECORD OF SPECIALIZED TRAINING

(PART B)

[List college courses, seminars, workshops, conferences, or other specialized training completed by manager, crew supervisor, worker, or trainee]

	COURSE DESCRIPTION	DATE STARTED/COMPLETED	COURSE LENGTH	REMARKS
1.	New Heating Unit Repair Techniques	Oct 2/Oct 4, 91	24 Clock Hours	Certificate of completion
2.	Principles of Management (MGT 230)	Jan 6/May 14, 92	3 S.H.	Grade: B
3.	Energy Management Seminar	Jun 1/Jun 5, 92	One Continuing Education Unit (CEU)	
4.				
5.				
6.				
7.				
8.				
9.				
10.				

RECORD OF COUNSELING

(PART C)

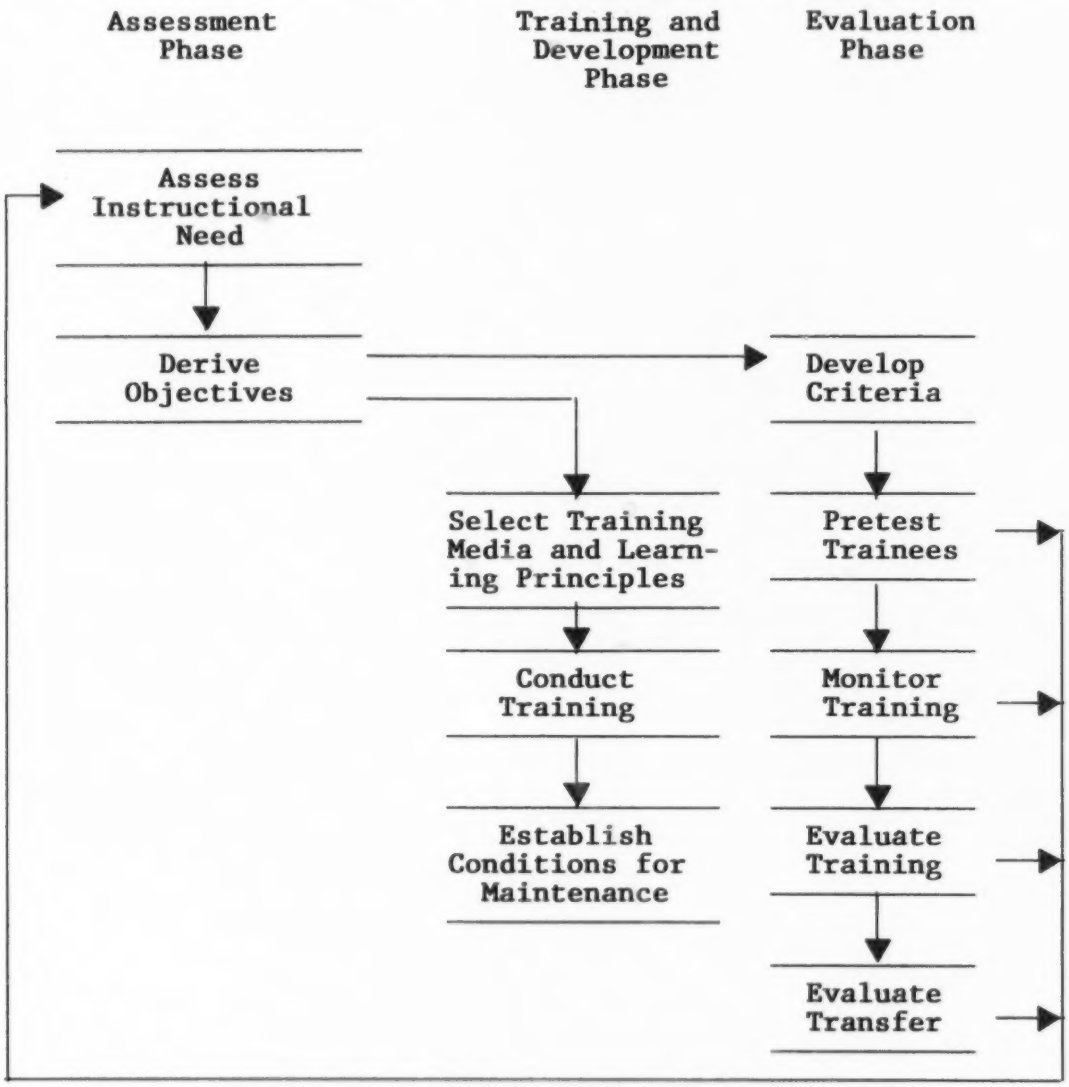
	SUBJECT DISCUSSED	DATE	SIGNATURE: COUNSELEE/ COUNSELOR	REMARKS
1.	Tardiness	Oct 2, 91	____/____ ____/____	45 minutes late to work.
2.	Violation of Safety Procedure	Oct 10, 91	____/____ _____	Failure to wear protective goggles.
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

APPENDIX D

MODEL FOR AN INSTRUCTIONAL SYSTEM

(SAMPLE)

Model for an Instructional System



Source: "Effective Personnel Management," 2d Edition, by Randall S. Schuler & Stuart A. Youngblood. West Publishing Co., St. Paul, Minnesota, 1986, page 395, as adapted from Training Program Development and Evaluation by Goldstein, p. 8, Copyright 1974. Wadsworth, Inc., Reprinted by permission of the publisher. Brooks/Cole Publishing Co., Monterey, California.

APPENDIX E

PROBLEM SOLVING IN THE WORKPLACE

(SAMPLE)

PROBLEM SOLVING IN THE WORKPLACE

The following approach is suggested for solving problems and making decisions in the workplace:

1. IDENTIFY THE PROBLEM: Determine the source of the problematic situation. Assess the what, where, when, who, and how of the situation. Attempt to correctly identify the actual problem and not a symptomatic condition.
2. ANALYZE THE FACTORS SURROUNDING THE PROBLEM: Collect all information possible about the problem. List and analyze all surrounding factors such as people, equipment, material, money, written and implied policies, or other factors that could have contributed to or caused the problem.
3. DEVELOP ALTERNATIVES: Develop some ideas that could be used to solve the problem. List as many ideas as you think are necessary to launch an attack on the problem. Be liberal and develop an expansive list of ways you believe the problem can be solved. Enlist the support of others in the workplace, by soliciting their ideas.
4. PRIORITIZE ALTERNATIVES: Carefully review the list of developed alternative solutions to the problem. Analyze each one and prioritize the alternatives in a chronological sequence (best to worst).

5. **IMPLEMENT CHOSEN ALTERNATIVE:** Put the treatment into action to solve the problem. Use extreme caution at this critical step. As the chosen treatment is applied to the problem, give close attention to every possible detail to ensure the problem is in fact being solved, and a symptom is not being treated.

6. **FOLLOW UP:** Use the rule of thumb, "If a problem happens once there is a fair chance the problem may happen again." Use a suspense system to periodically monitor the solved condition to determine if the problem is beginning to resurface, or if the problem is in fact still solved.